local wind direction is the only datum available, and I found that in the north of the Bay of Bengal, as the mean result of 132 measurements, the angle included between the wind arrow and the radius vector of the vortex was 122° (or 32° greater than a right angle), and that of twelve positions within 50 miles of the storm-centre, that is to say, in the inner circle of the hurricane, 123°. In the south of the bay it was 7° greater. Prof. Loomis, taking into account the land as well as the marine observations, and all barometric depressions, whether storms or otherwise, obtained an angle 25° greater, and differing only by 33° from the radial direction. It is hardly necessary to refer to Prof. Loomis's results of his examination of the Manilla cyclone of October 1882, which gave an angle of 118°, or to Mr. Meldrum's work on the cyclones of the South Indian Ocean, which has already been quoted by Mr. Archibald in his article in NATURE, mentioned above. All testify uniformly and in the strongest manner to the sharp spiral indraught of the winds in tropical cyclones, so that, as Prof. Loomis has truly remarked, "we thus see that tropical storms are spouts and not cyclones, and it is unfortunate that the term cyclone should have been ever adopted." In this view I fully agree, and I make M. Faye a present of the admission, that in an etymological sense, if in no other, Mr. Piddington's typical cyclones are not cyclones at all.

With all these results of a quarter of a century's experience present to my mind, when a gentleman holding the high position of M. Faye reiterates the assertion that the winds of tropical cyclones blow in circles, and that if ever they are found to blow spirally inwards such instances are not true cyclones (in the ordinarily accepted, *i.e.* denotative, meaning of the term), the impression I receive is somewhat such as M. Faye would probably experience were some equally eminent scientific authority to assert in his presence that the Ptolemaic system truly represents the relative movements of the sun and planets, and that the heliocentric scheme of Copernicus is a "prétendu système." If, indeed, M. Faye prefers to avail himself of the admission made above, to relegate Mr. Piddington's typical cyclones to the category of "prétendus cyclones," and therefore to exclude them from his theory, my present argument falls to the ground; but in that case his cyclone becomes the mere abstract definition of a term, and it remains to be shown that there is anything corresponding to it in Nature. That, however, in his latest communication to the *Comptes rendus*, he intended his assertions to apply to these tropical cyclones is abundantly apparent.

Can it be that M. Faye is unacquainted with the mass of original evidence embodied in the Indian cyclone reports, in Mr. Meldrum's writings on the cyclones of the South Indian Ocean, and with Prof. Loomis's work, in which these and many others are discussed? It would indeed seem so, since in none of his writings have I ever seen any reference to any other Indian author than Mr. Piddington, and even in his case it is difficult to believe that M. Faye has done more than simply accept Mr. Piddington's conclusions, without attempting to verify them by an examination of the original data. But if this be really the case—if he has taken so little pains to ascertain the fundamental facts, and to test the soundness of his speculations by an appeal to the evidence of the last twenty-five years—it is indeed strange that he can put forward confident assertions on a matter with which his acquaintance is so imperfect, and that he can disseminate statements that are demonstrably erroneous, and may be fraught with danger to the lives and property of those who accept him as their guide, backed with the high authority that must necessarily attach to his name.

It is a far from edifying spectacle to see such a man, in his latest communications to the *Comptes rendus*, quoting with complacency any isolated passage in the writings of leading meteorologists which seems to promise some support to his tottering theory, and ignoring all that would tell against it. That such cyclones as originate beyond the tropics are, in the first instance, movements of the higher atmosphere, has been rendered very probable by Dr. Hann's demonstration of the temperature relations of cyclones and anticyclones; but nothing that Dr. Hann has ever written has shown that he is in the least inclined to accept M. Faye's strange hypothesis of a descending current as the leading feature of cyclones and tornadoes. That the clearing of the skies in the central calm of a tropical cyclone may be due to the descent of a certain amount of air, although not decisively proved, is yet not improbable; but what would be thought of a man who, standing on a river bank, and seeing an upward current in the back-water immediately below him, should shut his eyes to the broad stream beyond, and assert, on the strength of his observation, that rivers flow from the sea to the mountains? Yet such, and no other, is the relation of this descending current to the great body of the cyclone. All may admit, with Prof. von Bezold, that there is much in the views hitherto prevalent as to the origin of cyclones and anticyclones that requires modification, and it may yet be long before these phenomena are fully and satisfactorily explained. There are many points of difference between the storms of the tropics and those of the temperate zone which seem to show that the forces that are principally active in the former play but a secondary part in the latter. But certainly there is no apparent tendency on the part of the leading meteorologists of Europe and America to accept M. Faye's *idolon specus* as a true theory of cyclones and tornadoes, nor is it in the least likely that such will ever be witnessed.

HENRY F. BLANFORD.

NOTES.

THE arrangements for the meeting of the British Association are now nearly complete. In a former note we referred among other matters to the excursions. We now learn that among them the organization of the pedestrian excursions to the Black Mountains is so far advanced that the detailed programme is now ready, and can be obtained by application to the Local Secretaries.

THE Royal Archæological Institute of Great Britain and Ireland opened their annual meeting in Edinburgh on Tuesday. At noon there was a reception of the members in the National Portrait Gallery by the President and Council of the Society of Antiquaries of Scotland. The inaugural meeting took place in the lecture-hall of the Royal Geographical Society. Sir Herbert Maxwell, on taking the chair, remarked that the closing years of a century naturally suggested the process of stocktaking, and as they had arrived at the last decade of a century which claimed to have witnessed beyond all precedent the accumulation of scientific knowledge, it was not unnatural that they should direct inquiry into the standing obtained by that particular branch of science in which they were all concerned. After a brief summary he stated that one of the problems which was pressing upon antiquaries at the present time was that relating to those mysterious rock sculptures which from time to time were found in increasing numbers all over Scotland. They bore a striking resemblance to similar rock sculptures found not only in Scandinavia and Central Europe, but in such remote parts of the earth as Asia, and Northern, Central, and Southern America. They could hazard no guess even at the race by whom they were made, still less at the object of their authors. All they could do was to record the discovery of them with careful drawings, and wait till perhaps light would flash upon them from the habit of some uncivilized tribe or from a passage in some hitherto unnoticed writer.

In the evening Dr. John Evans opened the Antiquarian Section with an address on the progress of archæology. The address covers the whole ground from Christy and Lartet's researches on the Dordogne to the Assyrian tablets.

BY an Imperial Decree of June 8, the Gold Medal for Art and Science was bestowed by H.I.M. the Emperor of Austria on Dr. R. Bowdler Sharpe, of the British Museum.

AT the graduation ceremony of the University of Edinburgh, held on the 1st inst., the Cameron prize was presented to Dr. Ferrier, F.R.S., by Prof. Fraser. Prof. Fraser said that Dr. Ferrier's researches had gained for him a well-merited fame throughout the whole civilized world. He had contributed to the alleviation of suffering in some of its most distressing and painful manifestations, and therefore the Senatus had thought that they were fully justified in awarding to him the prize, which had been founded for the recognition of important and valuable contributions to practical therapeutics. He had much pleasure in announcing further that Dr. Ferrier would, early next session, communicate to the University a paper describing some portion of his researches into this important subject. Prof. Ferrier, on appearing upon the platform to receive the prize, was received with most enthusiastic cheers.

AT a meeting of the Academy of Medicine of Paris on the 28th ultimo, Sir Joseph Fayrer, of London, and Dr. Bateman, of Norwich, were elected Associates of the Academy. These gentlemen had both been for some years Corresponding Members of the Academy, but they shared the Membership with only six other members of the profession in this country, viz. Sir James Paget, Bart., Sir Richard Owen, Sir Joseph Hooker, Sir Thomas Longmore, Dr. West, and Sir Spencer Wells, Bart.

DR. THORNE THORNE, F.R.S., has been elected a Corresponding Member of the Royal Italian Society of Hygiene.

PROF. DU BOIS-REYMOND has been elected Dean of the Medical Faculty of the Berlin University for this year. He has already more than once filled this post. Prof. Foerster, the astronomer, has been chosen Rector of the University.

HER MAJESTY'S Commissioners for the Exhibition of 1851 have offered nomination to Science Scholarships for the year 1892 to the following Universities and Colleges. The Scholarships are of the value of £150 a year, and are tenable for two years. The scholars are to devote themselves exclusively to study and research in some branch of science the extension of which is important to the industries of the country :—University of Edinburgh, University of Glasgow, University of Aberdeen; Mason College of Science, Birmingham; University College, Bristol; Durham College of Science, Newcastle; Yorkshire College, Leeds; University College, Liverpool; Owens College, Manchester; University College, Nottingham; Firth College, Sheffield; University College of North Wales, Bangor; Queen's College, Cork; Queen's College, Galway; University of Toronto, University of Adelaide, University of New Zealand.

IT has been decided to perpetuate the memory of the connection of Dr. Leidy with the University of Pennsylvania by raising a fund to endow the Chair of Anatomy and to found a memorial museum. Dr. Leidy was Professor of Anatomy for thirty-nine years, and his devoted services will be suitably recognized by connecting his name with the chair which he so long adorned.

THE arrangements for the World's Fair at Chicago seem to be advancing quickly. Seeing that so much benefit to science may be anticipated from the comparison of the best instruments and methods of working in use in different countries, which such exhibitions render possible, it seems a pity that political questions may render them less representative than might be wished. The *New York Nation* refers to the reluctance of French manufacturers to take part in the World's Fair, due to the bad feeling created by the McKinley Bill, and to the belief entertained that any expense incurred in exhibiting goods would be lost by reason of the commercial restrictions which that measure was intended to create and has created. "Nobody cares to spend his money for mere purposes of show. Unless trade follows as a consequence of the exhibition, the money will be sunk. . . . . It does not advance matters, or help on the Fair, to show that both countries are wedded to a false system. It should serve, however, to open the eyes of people on both sides to the absurdity of inviting each other to show their goods, and then creating barriers to prevent each other from buying and selling. Imagine an American McKinleyite meeting his French brother at a World's Fair in Paris or in Chicago, and exhibiting to the latter a choice lot of provisions put up in Mr. Armour's most approved style, while the latter exhibits a fine assortment of woollens, silks, gloves, &c. If they could look in each other's faces without laughing, they must have a gravity exceeding that of two Roman augurs. Ordinary self-respect ought to teach the commercial classes of both countries to keep away from World's Fairs until they learn the A B C's of trade."

E pur si muove. Technical instruction in the provinces is growing apace, small thanks to our statesmen and legislators, for we owe to an accident the possibility of meeting the most crying needs of the time. We may refer to what is going on in Lancashire as an indication of the general awakenment. The total sum available for technical instruction is £40,391, and, after the sums already guaranteed by the County Council and some special amounts now in question are taken into account, there is a balance of about £29,000 to be dealt with, which the committee of the Council recommend should be apportioned between the urban and rural districts of the administrative county on the dual basis of rateable value and population. The committee recommend that a director of technical instruction be appointed at £500 per annum, with travelling expenses; that £3600 be set apart to provide twenty scholarships not exceeding £60 each for a term not exceeding three years, apportioned as follows—eight for science (tenable at Owens College, Liverpool University College, or other approved public institution), two for art, four for commercial subjects, and six for the science of agriculture, including horticulture; that £1200 be set apart for providing eighty exhibitions of £15, tenable for one year at Owens College and Liverpool University College evening classes, or at some approved technical, commercial, or intermediate school, to be apportioned as follows—thirty-two exhibitions for science, eight for art, sixteen for commercial subjects, and twenty-four for agriculture; that £2000 be set apart for founding travelling scholarships and free studentships of £1 to £10 to assist students in attending technical schools; that the various urban and rural sanitary authorities, through or in conjunction with any district committees that may be appointed, be permitted to nominate candidates for the above, two-thirds of whom shall be children of parents whose incomes do not exceed £300 per annum; that all the scholarships and exhibitions be opened to students of both sexes resident in the county; that a sum not exceeding £1000 be granted for the purpose of aiding University Extension lectures; that a sum not exceeding £500 be granted to carry out the arrangements with the council of the Harris Institute in Preston for the promotion of technical instruction in agriculture; and that a sum not exceeding £1000 be granted for staff and office expenses. The migratory dairy school having been much appreciated, arrangements have been made to start a second school at Ulverston on August 11. A scheme for agricultural instruction is also being arranged (estimated to cost £500 per annum), but the details have not yet been finally settled.

THE managers of the New Gallery announce a "Victorian Exhibition," covering the fifty years of Her Majesty's reign from 1837 to 1887. As in the case of the preceding exhibitions, it will contain pictures and other records of events illustrating the history of the Royal Family and of the nation; and it will contain, above all, a series of portraits of the illustrious men and women who, in so many different ways, have made their mark upon the age. We gather from an article in the *Times* that science, in this of all reigns, is not likely to fall behind. We are promised pictures of Charles Darwin, Faraday, and Sir John Herschel, of Lyell and Murchison, of the two Stephensons, of Fox Talbot, one of the inventors of photography, and of Wheatstone, one of the inventors of the telegraph. The article adds that "it would be easy to quadruple this list, supposing the eminent men of science to have had the time and the vanity to sit for their portraits." We agree.

THE *Pall Mall* returns to the charge on the subject of the imagined unpopularity of the British Museum, and states that although the evening openings have so far been a failure, and a very costly failure, the first installation of the electric light costing over £17,000, the problem is being carefully considered. It is also stated that it is an open secret that for some years past the Trustees have been unanimous in favour of Sunday opening, which, as they have more than once pointed out, would entail little or no extra work on the officials, but merely change of work for a few policemen. Among the things that are wanted are certainly continuity in the hours during which the Museum is open on any one day, and the possibility of obtaining some decent refreshment. If in these matters the Trustees will imitate the arrangements at the South Kensington Museum, we believe the attendance will be increased—the attendance of workers certainly will.

WE are requested to state that the designs submitted in competition for the completion of the buildings of the South Kensington Museum are now on view at that Museum from 10 till 6.

DURING the whole month of July little variation in the state of Vesuvius was observable; the lava flowed steadily on, and had at one time extended down the Fossa della Vetrana, nearly opposite the lodge and gate of Messrs. Cook's private road to the Vesuvian railway, but immediately cooled, and again started flowing much nearer its source. At the summit of Vesuvius the vapour appeared to issue almost as in the normal state of the mountain, except for momentary interruptions and occasional ejection of dust and sand. Dr. Johnston-Lavis, who has recently visited the scene, sends us the following details:—"On July 30, I again visited the top of the great cone. The central crater has considerably enlarged, and has now an elliptical plan, with the major axis directed north-west to south-east, but this form has been derived from its original circular shape by the greater destruction of the lips towards the south-east. The edges were in a most unstable state, and attempts at photographing the interior were accompanied by considerable danger, and required many precautions. On the inner walls I was, however, able to make out several dykes besides the hollow one that has supplied the great eastern rift for its several eruptions from 1881–82 to 1890. These may be enumerated as directed north-east; north-north-west, probably the dyke formed at the commencement of this eruption; north-west; south-west, probably the cooled upper extremity of the lava sheet filling the south-west fissure which I have so often mentioned; and lastly, the hollow dyke to the south-south-east, which supplied the lava of May 1885, is again exposed. There may be other dykes, but the large amount of vapour filling the crater, and the danger and impossibility of approaching the edges in most parts, prevent a very detailed examination. So far as I could make out, the situation of the vent is quite to the south-east of the crater bottom, so that this fact, combined with the prolongation of the crater in that direction and the existence of numerous radial fissures, would indicate that the general tendency is for the next lateral disruption to take place towards Pompeii, or Torre Anunziata. On July 30 the lava was flowing very slowly just at the junction of the Atrio del Cavallo and the Fossa Vetrana. To an experienced observer the whole state of the mountain is still very unstable, and a fresh outburst might occur at any moment, although the volcano may gradually quiet down. But a few days before my visit, four strong earthquakes were felt at the lower railway station, showing that important fracturing, injection, or other dynamic disturbances were taking place in the great cone."

WE have received from Mr. C. Mostyn an interesting letter on the well-known appearance of the green ray at sunrise or sunset caused by the refraction of the air. He states:—"This 'green ray' is seen to best advantage at sun-*rise*, owing I imagine to the eye not being wearied with watching the previous glare, as is apt to be the case at sunset. At the same time, I had many very satisfactory observations at sunset, one in particular, when we were running before a very heavy sea in the Southern Ocean, and the 'green ray' was seen no less than three times in as many seconds, as the ship rose and fell on the huge waves causing as it were two sunsets, with a sunrise between them. The best displays took place when the refraction near the horizon was of such a character that the sun assumed a balloon, or vase, shape as he came close to the sea-line. When, on the contrary, the sun appeared flattened out in its horizontal diameter, the 'green ray' was either entirely absent, or was seen only in an indistinct and uncertain manner."

SIR EDWARD WATKIN having now, we presume, cured unpunctuality on the many lines of railway which he is highly paid to manage, is again turning his attention to Snowdon. It will be remembered that he proposed in the first instance to erect an astronomical observatory there. This, of course, was ridiculous. We are now told that the authorities of the Trinity House have expressed warm approval of his more recent proposal to place an electric light on the summit. The Elder Brethren consider that the light should prove an invaluable addition to those already erected round the North Wales coast for the guidance of mariners. Sir Edward hopes to have the light burning before Christmas.

THE Directors of the Crystal Palace, in deference to the wish of the Electrical Trade Section of the London Chamber of Commerce, have decided to postpone the opening of the Electrical Exhibition from November 1891 till January 1, 1892, on which date the Exhibition will be formally opened.

WE learn from the *Photographic News* that the great progress that has been made in the methods by which rapid movements can be analyzed is well seen in a series of photographs lately taken by Anschütz, of Lissa, who has already given to the world some of the best instantaneous pictures ever taken. The subject of the pictures at present under consideration is a dog jumping over a small bush. In the act of making one jump the animal has been photographed twenty-four separate times, and each picture is not a mere silhouette, as was the case with Muybridge's first attempts of this kind, but a little picture showing half-tone and detail. Some of the attitudes are, of course, comic in appearance, for they represent phases of a movement which the eye is unaccustomed to, and cannot possibly appreciate. Notably is this the case in the commencement of the jump, when the dog's hind toes only touch the ground; and again at the finish of the jump, when his legs are gathered together in a heap.

A German specialist, Dr. Cold, has recently pleaded for giving young people more sleep. A healthy infant sleeps most of the time during the first weeks; and, in the early years, people are disposed to let children sleep as much as they will. But from six or seven, when school begins, there is a complete change. At the age of ten or eleven, the child sleeps only eight or nine hours, when he needs at least ten or eleven, and as he grows older the time of rest is shortened. Dr. Cold believes that, up to twenty, a youth needs nine hours' sleep, and an adult should have eight or nine. With insufficient sleep, the nervous system, and brain especially, not resting enough, and ceasing to work normally, we find exhaustion, excitability, and intellectual disorders gradually taking the place of love of work, general well-being, and the spirit of initiative.

The *Entomologist's Monthly Magazine*, among much interesting matter, refers to the possibility of the destruction of some of the inclosures in the New Forest which have proved themselves to be among the happiest hunting-grounds of the entomologist.

A recent number of the Proceedings of the Academy of Natural Sciences of Philadelphia contains a paper on Echinoderms and Arthropods from Japan, by Mr. J. E. Ives. The specimens described were collected by Mr. Frederick Stearns, of Detroit. The new species of Echinoderms and Crustacea are enumerated. A new Ophurian, a new crab, and a new Pycnogonoid are described, and several species of star-fishes hitherto unfigured are illustrated. The plates are admirable.

Bulletin No. 10 of the University College of Agriculture at Tokyo contains an account of some manuring experiments with paddy rice (second year) by Dr. O. Kellner, Y. Kozai, Y. Mori, and M. Nagaoka. The principal purpose of the researches carried out in 1889, and reported in Bulletin No. 8, was to ascertain how much nitrogen, phosphoric acid, and potash can be consumed by rice from the stock of nutrients in the unmanured soil, and how much of them is needed in the manure for the production of a maximum crop if the three nutrients are applied in the most assimilable form. On the basis of the results then obtained, the present experiments were tried with the object of getting information on the following questions:—(1) How much nitrogen, phosphoric acid, and potash is taken up from those plots which had not received the respective nutrients in the preceding year? (2) What is the effect of unrecovered phosphatic manure on the succeeding crop? (3) How much nitrogen can be supplied to rice by the preceding cultivation of a leguminous plant (*Astragalus lotoides*, Lam.) for green manuring? (4) What is the effect of various phosphatic fertilizers on rice? (5) What is the effect of various nitrogenous manures on rice? The work seems to have been carefully done, and affords a good instance of the way in which scientific questions are now being treated in Japan.

The July number of the Proceedings of the Society for Psychical Research has reached us, and contains the following contributions:—"On Alleged Movements of Objects, without Contact, occurring not in the Presence of a Paid Medium," by Mr. F. W. H. Myers; "Experiments in Clairvoyance," by Dr. A. Backman; and "A Case of Double Consciousness," by Mr. R. Hodgson.

At the Bournemouth meeting of the British Medical Association, a discussion on the subject of alcohol was initiated by a paper by Dr. Samuel Wilks. In the course of his paper he stated that he had no acquaintance with any organic changes attributable to alcohol in the lungs and kidneys, but it seemed that the digestive and nervous systems suffered. Physiologists had failed to demonstrate the chemical changes which it underwent in the body, and consequently it was impossible to say whether it was of the nature of a food or not. No one had yet seen a person who lived on alcohol, although there was evidence of persons taking large quantities of alcohol who yet preserved their weight with a minimum of food; and that supported the theory that, although alcohol was not nutritive in itself, it prevented the wear and tear of the body. The opposite theory also existed, that alcohol acted as a spur to the nervous system and quickly wore it out. He could not disapprove of the use of wine and beer, if taken in moderation, by the masses of the people; but as to spirits or spirits and water, he had not made up his mind that they were in any way useful, and he seldom recommended them. Dr. Bucknill thought that the wise use of wine might cure some cases and be useful in others. Dr. Norman Kerr said that alcohol was a poison, analogous in many respects to other poisons. Sir Risdon Bennett agreed with Dr. Wilk in not approving of spirits as a beverage. He believed it to be useful in fever and in some nervous diseases, but he did not think it desirable at the present time to lay down any broad principles with regard to alcohol with reference to the whole community.

The Philadelphia *Satellite* states that, during the abortive attempt to cut a canal through the isthmus of Panama, as much as 200,000 ounces of quinine were used annually in combating malarial fever.

According to the *Pharmaceutical Journal of Australia*, the practice has been introduced into Victoria, on the recommendation of Baron von Mueller, of placing green branches of eucalyptus in sick rooms as a disinfectant. Dr. Curgenven states, after twelve months' trial, that in cases of scarlet fever, if the branches be placed under the bed, the bedding undergoes thorough disinfection, the volatile vapour penetrating and saturating the mattress and every other article in the room. Its vapour is also said to have a beneficial effect upon phthisical patients, acting not only as an antiseptic, but as a sedative and to some extent as a hypnotic.

The Bulletin of the (American) Essex Institute just received contains an account of the annual meeting held last May, and a retrospect of the year, from which we learn that Mr. Perley, in a lecture on "Old-time Winters in Essex County," gave interesting particulars on many subjects, including weather. We give the following extract:—"The lecturer spoke of the watch, church services, dress, food, and schools of the early winter seasons; how the people spent their evenings, the winter employment of the people in cutting off the forests, sledding timber and wood, making pipe staves and barrel hoops, and, most interesting of all, the institution of the old-fashioned shoemakers' shops, of which nearly every farm had one a century ago. Women in those days engaged in spinning and weaving. The holidays were referred to—Thanksgiving, Christmas, and New Year's; and the winter pleasures, such as sleigh-rides, dancing, spinning and quilting parties, and games, shuffle-board, coasting, skating, trapping, gunning, fishing, singing-schools, and girls' samplers. He also spoke of the old modes of travel, snow-shoes, &c. Nearly all the heavy teaming was done on sleds, and he mentioned the winter of 1768-69, when the travelling was so bad that the farmers in the western part of the State could not get their grain and provisions to the coast to market. Snow remained on the roads as it fell until about a century ago. Mr. Perley then spoke of particular winters: that of 1641-42, when the Indians said they had not seen the ocean so much frozen for forty years; of 1646-47, when there was no snow to lay; of 1696-97, said to be the coldest winter since the first settlement of New England; of 1701-2, which was 'turned into summer'; of 1717-18, when the snow was from ten to fifteen feet deep and the drifts twenty-five feet, many one-story houses being buried; of 1740-41, said to be the severest winter known by the settlers, Salem Harbour being frozen over as early as October; of 1774-75, a wonderfully mild winter; of 1779-80, when for forty days, including March, there was no perceptible thaw, and the snow was so hard and deep that loaded teams passed over the fences in any direction, arches being dug under the snow so that men on horseback could ride under them, and which was long remembered as *the* hard winter; of 1784-85, when, as late as April 15, snow was 2 feet deep, and frozen hard enough to bear cattle; of 1785-86, when in the remarkable storm of November 25, the snow blew into balls, one of which had rolled 76 feet, measuring 17½ by 22 inches; of 1794-95, when the *Betsey* was launched in Salem on Christmas Day, the thermometer indicating 80° above zero at noon, and men and boys went in swimming; of 1801-2, when the *Ulysses*, *Brutus*, and *Volutia*, three Salem vessels, which sailed out of the harbour on a summer-like morning in February, were all cast away at night on Cape Cod, in a terrible snowstorm, which continued a week. He also referred to more recent seasons, and of the cold winter of 1856-57, when in one week in January was the coldest day by the thermometer ever recorded of late years, mercury in Salem 20° below zero; travel on the railroad between Boston and Salem entirely suspended from Tuesday morning to Thursday afternoon. The recent mild winters were also alluded to."

IN the volume of Bavarian meteorological observations for 1890, Dr. C. Lang (the Director of the Service) contributes an article on the "Secular Variations of Damage by Lightning and Hail." He points out that in almost all recent investigations the conclusions come to are that during the last 50 years damage by lightning has much increased, but this is not borne out by his inquiry, but is probably owing to more attention having been paid to the subject recently. The numerous impurities introduced into the air of towns from fire-places, &c., would make it probable that they would be more liable to damage than country places, but exactly the opposite is the case, the ratio of damage to buildings in towns to that in the country being 1 : 2. This result is possibly to some extent due to the more numerous lightning-conductors, and to railway lines in the towns. He finds that the damage from hail shows a very probable connection with the period of sun-spot frequency, but the secular range of the former points more particularly to the influence of temperature, so that the curve of hail-frequency shows, not only a minimum occurring with the 11-year sun-spot maximum, but also a period of about 35 years. The damage from lightning, on the other hand, does not show any connection with a secular range of temperature, but the minimum occurs with the maximum of sun-spot frequency. In other words, damage from hail seems to be more decidedly connected with terrestrial, and damage from lightning more with cosmical influence.

THE application of science in the direction of domestic comfort seems to be advancing with great strides in the United States. The *Nation*, in reference to the announcements that the inhabitants of Kansas City are about to be supplied with cool air in summer and warm air in winter through a system of pipes laid in the streets; and that the people of Framingham, Mass., are to be furnished with gas for heating purposes at the price of 50 cents a thousand feet, thus writes:—"Thus the ends of the land are advancing in the art of living while the metropolis remains stationary, and is kept from falling behind only by incessant grumbling. And yet the possibilities of comfort, of health, and even of cheapness revealed in these schemes are wonderfully alluring, and their realization would be prevented by no physical obstacles. If we consider that wonderful work of human hands, the kitchen range, under the management of the regular cook, who knows how to put on all the draught at once and keep it on, what a devourer of fuel it is! We need a cup of tea or a chop in summer, and a fire is kindled that would generate steam enough to drive an ocean racer a mile upon her course, the kitchen is turned into a Tophet, the miserable servants swelter in the apartments which their own stupidity and that of mankind have rendered uninhabitable, and their employers are rendered uncomfortable above. The extravagance of the Chinese, who, as related by Charles Lamb, at first thought it necessary to burn down a house whenever they wanted to roast a pig, is nothing to ours." Has anybody ever calculated the annual waste caused by the above described "use" of the ordinary "kitchen range"?

AN interesting paper upon the slow combustion of explosive gas mixtures is contributed to the current number of *Liebig's Annalen* by Dr. Krause and Prof. Victor Meyer. The experiments described were made with electrolytic mixtures of hydrogen and oxygen, and detonating mixtures of carbon monoxide and oxygen. The first experiment consisted in heating in a bath of vapour of diphenylamine (305°) a detonating mixture of hydrogen and oxygen contained in a U-shaped tube closed by mercury. The heating was continued without intermission for a fortnight, at the end of which time very little gas remained, almost the whole having slowly combined to form water. The experiment was then repeated in an apparatus constructed entirely of glass, and in which the use of mercury was avoided, except in a small manometer used to indicate the pressure. It was then found that no trace of water was formed at the temperature of diphenylamine vapour (305° C.); at the temperature of boiling sulphur (448°) the amount of combination was exceedingly small; while at 518°, the boiling-point of phosphorus pentasulphide, a considerable amount of combination occurred, but no quantitative rule could be deduced. In all these experiments the gases employed were moist, and no particular care had been taken to remove the last traces of admixed air. Now Bunsen and Roscoe, in their celebrated work on detonating mixtures of hydrogen and chlorine, showed that regular results were only obtained when the film of air condensed upon the surfaces of the glass vessels employed was removed by allowing the gas to stream through the apparatus for several days previous to the experiment. A fresh series of experiments were therefore made, in which these precautions were most rigidly observed; most complicated pieces of apparatus were constructed of glass throughout, which admitted of the drying of the gases prepared (in case of hydrogen and oxygen) by the electrolysis of hot water, so as to exclude ozone and hydrogen peroxide; and the pure gases thus obtained were allowed to stream through the series of bulbs united by capillary tubes for a fortnight, night and day, before the bulbs were sealed off at the capillaries. It was found that, with pure dry gases, scarcely a trace of combination occurred by the fusion of the very fine capillaries. As regards the temperature of ignition of electrolytic hydrogen and oxygen, or detonating carbon monoxide and oxygen, it was found that bulbs containing them do not explode when placed in boiling pentasulphide of phosphorus (518°), but do explode in vapour of stannous chloride (606°). The temperature of ignition lies, therefore, between 518° and 606° C. The mode of explosion differs considerably under different circumstances. In case of explosion in vapour of stannous chloride, the bulb was never shattered, but a sudden appearance of flame within the bulb occurred, accompanied by a slight detonation, and in some cases the point of the capillary was blown off. It is also astonishing how long one requires to hold such a bulb in a Bunsen flame before explosion occurs; it never occurs until the flame becomes coloured yellow, and the glass begins to soften, and frequently only causes a swelling out of the glass at the heated spot. Thin-walled bulbs, however, are sometimes shattered. In two cases it was noticed that the glass at the softened part was violently forced in, owing to the previous heating having caused a large percentage of combination, and hence the production of a partial vacuum. Even after taking the rigid precautions to insure purity above described, no definite quantitative rule connecting the time and percentage of combination has been discovered, experiments performed simultaneously upon similarly treated mixtures yielding widely different results; showing that the irregularities of glass surfaces, even after removal of their air-films, are quite sufficient to modify very sensibly the conditions under which combination occurs.

THE additions to the Zoological Society's Gardens during the past week include an Egyptian Gazelle (*Gazella dorcas*) from North Africa, presented by Mr. S. C. Saunders; a Ring-tailed Coati (*Nasua rufa*) from South America, presented by Mr. Edward J. Brown; two Herring Gulls (*Larus argentatus*), British, presented by Mr. T. A. Cotton; two White-bellied Sea Eagles (*Haliaëtus leucogaster*) from Australia, presented by Mr. Hugh Nevill, F.Z.S.; a Lesser Sulphur-crested Cockatoo (*Cacatua sulphurea*) from Moluccas, presented by Miss Partridge; three Barbary Turtle Doves (*Turtur risorius*) from North Africa, presented by Miss D. Bason; an Indian Cobra (*Naia tripudians*) from India, presented by Mr. H. E. Lindsay; two Harnessed Antelopes (*Tragelaphus scriptus* ♂ ♀) from Gambia, a —— Paradoxure (*Paradoxurus aureus*) from Ceylon, two Grey Ichneumon (*Herpestes griseus*) from India, four grey Parrots (*Psittacus erithacus*) from West Africa, deposited.

OUR ASTRONOMICAL COLUMN.

THE SPECTRUM OF β LYRÆ.—A study of twenty-nine photographs of the spectrum of β Lyræ has led to some interesting results, noted by Prof. E. C. Pickering in *Astronomische Nachrichten*, No. 3051. The spectrum of this star contains, in addition to the absorption lines, several bright lines, the most conspicuous of which are about λλ 486, 443, 434, 410, 403, and 389, to use a three-figure reference. The lines near λ 443 and λ 403, are two of the most prominent lines in the spectra of the Orion stars, and the remaining four coincide with the hydrogen lines F, G, *h*, and *α*. From the investigation it appears that these bright lines change their positions, so that sometimes they have a greater wave-length than the corresponding dark lines, whilst at other times the reverse is the case. In some of the photographs several bright lines are double, and the dark lines are also not free from changes. This naturally led to the inquiry as to whether the changes were connected with the variations of the star's brightness. Starting from a minimum of brightness there is a maximum at 3d. 5h., a secondary minimum at 6d. 11h., another maximum at 9d. 16h., and then the principal minimum is again reached after a total period of 12d. 22h. The point of interest is that the fourteen plates in which the wave-length of the bright lines was increased were taken during the first half of this period of variation—that is, before the secondary minimum; whilst on the eleven plates taken during the second half of the period the displacement was towards the blue end of the spectrum. And since the photographs extend over more than four years, there can be little doubt that the displacements are intimately connected with the variations of the star's brightness. One of the explanations suggested by Prof. Pickering to account for the observed phenomena is that the bright lines are emitted by an object revolving in a circular orbit round the principal star, with a maximum velocity of about 300 miles per second, and completing its circuit in a period of 12d. 22h. The corresponding periastron distance is about 50,000,000 miles. If this be so, β Lyræ is a binary of the β Aurigæ type, but differing from it in the fact that the component stars have unlike spectra. The phenomena could also be produced by a meteor stream, or by an object like the sun, rotating in 12d. 22h., and having a large protuberance on it extending over more than 180° of longitude. The study of the additional photographs which are being taken will doubtless elucidate the matter.

THE POLARIZATION THEORY OF THE SOLAR CORONA.—In the Publications of the Astronomical Society of the Pacific, vol. iii. No. 16, 1891, Prof. Frank H. Bigelow gives some further results of his investigations of coronal forms, and arrives at some new results. It can be shown that in the case of repulsion of matter in a spherical rotating body like the sun, two poles of repulsion are formed, and the body is polarized about an axis. Within the body the lines of force are parallel to the axis of polarization, and their curvature outside the surface may be calculated. Applying these considerations to the similar coronal forms exhibited in the eclipse photographs of July 1878 and January and December 1889, Prof. Bigelow finds that the axis of polarization is at the surface of the sun about 4½° from the axis of rotation, and taking the radius of the sun as 866,500 miles, the length of the axis to which the lines of force are parallel is 1,729,700 miles. Its direction is fixed, and in 1878 the north and south coronal poles had the positions, north pole = 201°·2, south pole = 301°·6, when referred to the ascending-node of the sun's equator on the plane of the ecliptic. If 138 + 349°·85, 151 + 311°·40, and 12 + 312°·55 be taken as the number of revolutions and the angular excess during the three intervals between the dates of the above eclipses, the mean daily motion in longitude at the latitude of the coronal pole, 85°·5, is found to be 13°·13307. From this the following periods of the sun's rotation in latitude 85°·5 is deduced—

Sidereal period 27·41171d. = 27d. 9h. 52m. 52s.
Synodic period 29·63580d. = 29d. 15h. 15m. 33s.

The formula proposed to express the rotation-period in different solar latitudes is $X = 862' - 76' \sin l$, where X is the mean daily motion in minutes, and l the latitude. With these elements it is possible to predict the positions of the coronal poles at any epoch, and in consequence the relative form of the corona at the time, as seen from the earth. A comparison of the calculated results and photographs, obtained during some recent eclipses, displays a striking concordance. The investigation "also serves to strengthen the conviction that the sun-spots are probably formed by the descent of material from the extremities of the coronal streamers, in a vertical direction upon the sun."

OBSERVATIONS OF THE MOTION OF SIRIUS.—At the Berlin Academy of Sciences on June 4, Prof. Vogel communicated some observations of the motion of Sirius in the line of sight. Using the iron spectrum as the term of comparison with the spectrum of the star, it was found that the velocity of approach on March 22 was 1·96 geographical miles per second with respect to the sun. With hydrogen comparison lines the velocity found was 1·73 miles per second.

RETURN OF ENCKE'S COMET.—A telegram from the Lick Observatory to Prof. Krüger, announces that Encke's periodic comet has been observed on its return by Mr. Barnard on August 1·9958 G.M.T., in the position R.A. 3h. 55m. 20·6s., Decl. 29° 59'·1 N.

ON SOME TEST CASES FOR THE MAXWELL-BOLTZMANN DOCTRINE REGARDING DISTRIBUTION OF ENERGY.[1]

(1) MAXWELL, in his article (*Phil. Mag.*, 1860) "On the Collision of Elastic Spheres," enunciates a very remarkable theorem, of primary importance in the kinetic theory of gases, to the effect that, in an assemblage of large numbers of mutually-colliding spheres of two or of several different magnitudes, the mean kinetic energy is the same for equal numbers of the spheres irrespectively of their masses and diameters; or, in other words, the time-averages of the squares of the velocities of individual spheres are inversely as their masses. The mathematical investigation given as a proof of this theorem in that first article on the subject is quite unsatisfactory; but the mere enunciation of it, even if without proof, was a very valuable contribution to science. In a subsequent paper ("Dynamical Theory of Gases," Phil. Trans. for May 1866) Maxwell finds in his equation (34) ("Collected Works," p. 47), as a result of a thorough mathematical investigation, the same theorem extended to include collisions between Boscovich points with mutual forces according to any law of distance, provided only that not more than two points are in collision (that is to say, within the distances of their mutual influence) simultaneously. Tait confirms Maxwell's original theorem for colliding spheres of different

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[1] Paper read at the Royal Society by Sir William Thomson, D.C.L., P.R.S., on June 11, 1891.